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# PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 29 November 2000 (29.11.00)	
<b>International application No.</b> PCT/US00/07692	<b>Applicant's or agent's file reference</b> 102014-101
<b>International filing date (day/month/year)</b> 21 March 2000 (21.03.00)	<b>Priority date (day/month/year)</b> 22 March 1999 (22.03.99)
<b>Applicant</b> MORE, Dominick, G. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
21 September 2000 (21.09.00)

☐ in a notice effecting later election filed with the International Bureau on:  
\_\_\_\_\_

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b>  Henrik Nyberg  Telephone No.: (41-22) 338.83.38
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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 19 OCT 2001

WIPO PCT

Applicant's or agent's file reference 102014-101	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/07692	International filing date (day/month/year) 21 MARCH 2000	Priority date (day/month/year) 22 MARCH 1999
International Patent Classification (IPC) or national classification and IPC IPC(7): F16J 15/08 and US Cl.: 277/606		
Applicant THE ADVANCED PRODUCTS COMPANY		

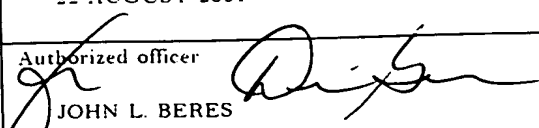
1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets.  
☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

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Date of submission of the demand 21 SEPTEMBER 2000	Date of completion of this report 22 AUGUST 2001
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer  JOHN L. BERES
Facsimile No. (703) 305-3230	Telephone No. (703) 308-2166

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/07692

## I. Basis of the report

1. With regard to the elements of the international application:\*

☐ the international application as originally filed  
☒ the description: \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_ (See Attached) \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_  
 pages \_\_\_\_\_

☒ the claims: \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_ (See Attached) \_\_\_\_\_, as amended (together with any statement) under Article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_  
 pages \_\_\_\_\_

☒ the drawings: \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_ (See Attached) \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_  
 pages \_\_\_\_\_

☒ the sequence listing part of the description: \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_ (See Attached) \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_  
 pages \_\_\_\_\_

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.  
 These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

☒ the description, pages \_\_\_\_\_ NONE  
☒ the claims, Nos. \_\_\_\_\_ NONE  
☒ the drawings, sheets/fig. \_\_\_\_\_ NONE

5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\*Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/07692

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. statement

Novelty (N)	Claims	1-5 and 10-12	YES
	Claims	6-9 and 13	NO
Inventive Step (IS)	Claims	None	YES
	Claims	1-13	NO
Industrial Applicability (IA)	Claims	1-13	YES
	Claims	None	NO

### 2. citations and explanations (Rule 70.7)

Claims 6-9 and 13 lack novelty under PCT Article 33(2) over Halling (U.S. 4,218,067).

Halling discloses a seal comprising an outer metallic member (16) and an inner metallic member (14). Both members being a general c-shape in cross-section. The inner member has a thickness about 4 times the thickness of the outer member. The inner member is formed of a nickel-based alloy and the outer member is formed of an aluminum material or copper. Halling also discloses the seal capable of controlling leakage. Halling further discloses a method for the manufacture of the seal (col.2, lines 40-48).

Claims 1-5 and 10-12 lack an inventive step under PCT Article 33(3) as being obvious over Halling (U.S. 4,218,067) in view of de Villepoix et al (U.S. 4,561,662). Halling discloses the invention substantially as claimed, as set forth in the rejection above. However, Halling does not disclose the outer member having a pair of oppositely outward-projecting ridges nor the seal having a straight section. de Villepoix et al teaches that a seal can include an outer member (16) that includes projecting portions or ridges (20) and flat or straight sections that the ridges are position on. The ridges make it possible to rapidly obtain a very good seal for a small force. The seal of Halling can be modified by the teachings of de Villepoix et al to include the ridges and straight sections, in order to obtain a very good seal for a small applied force.

----- NEW CITATIONS -----  
NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US00/07692

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

**I. BASIS OF REPORT:**

This report has been drawn on the basis of the description,  
page(s) 1-5, as originally filed.  
page(s) NONE, filed with the demand.  
and additional amendments:  
NONE

This report has been drawn on the basis of the claims,  
page(s) NONE, as originally filed.  
page(s) NONE, as amended under Article 19.  
page(s) NONE, filed with the demand.  
and additional amendments:  
Pages 6-8, filed with the letter of 28 July 2001.

This report has been drawn on the basis of the drawings,  
page(s) 1-3, as originally filed.  
page(s) NONE, filed with the demand.  
and additional amendments:  
NONE

This report has been drawn on the basis of the sequence listing part of the description:  
page(s) NONE, as originally filed.  
pages(s) NONE, filed with the demand.  
and additional amendments:  
NONE

## CLAIMS

1. A vacuum seal (20; 120) for sealing a pair of opposed metal flanges (110A, 100B), the seal (20; 120) comprising an outer metallic annular member (24; 124) having a generally c-shaped longitudinal radial cross-section and an inner metallic annular member (22; 122) having a generally c-shaped longitudinal radial cross-section, wherein the outer metallic annular member (24; 124) has a pair of oppositely-directed, longitudinally outward-projecting, ridges (40A,40B) for deformably engaging the pair of opposed metal flanges (100A,100B) and the inner metallic annular member has longitudinal strength and elasticity effective to maintain the ridges (40A,40B) in engagement with the flanges.
2. The seal of claim 1 wherein the inner metallic annular member (22; 122) provides the primary structural integrity of the seal.
3. The seal of claim 1 wherein the inner metallic annular member (22; 122) has a characteristic thickness of between about 2 and 4 times a characteristic thickness of the outer metallic annular member (24; 124).
4. The seal of any of claims 1-3 wherein the inner metallic annular member (22; 122) is formed of a nickel-based superalloy and the outer metallic annular member (24; 124) is formed of an aluminum-based material.
5. The seal of any of claims 1-3 wherein the each of the ridges has a longitudinal extent ( $L_3$ ) beyond a thickness of the outer member away from the ridges.
6. An annular vacuum seal (20; 120) for sealing first and second opposed flanges (100A,100B) to maintain an internal pressure less than an external pressure, the seal (20) having nested inner (22; 122) and outer (24; 124) members and having a longitudinal radial section which is characterized by:
- the outer member (24; 124) being generally c-shaped and open radially outward; and
- the inner member (22; 122) nested within the outer member (24) and being generally c-shaped and open radially outward and having a wall thickness effective to maintain the outer

member in engagement with the first and second flanges in the absence of a spring nested within the inner member.

7. The seal of claim 6 wherein:

5 the inner member (22; 122) has a full plating of a copper-base material.

8. The seal of claim 6 wherein:

the inner member (22; 122) is formed of a nickel-base superalloy; and  
the outer member (24; 124) is formed of an aluminum-base material.

10

9. The seal of any of claims 6-8 being effective to provide a leakage rate of no more than about  $4 \times 10^{-12}$  cm<sup>3</sup>/s-mm.

10. The seal of any of claims 1-3, 6-8 wherein the inner metallic annular member (122)  
15 longitudinal radial cross-section has a central arcuate portion (150) and a pair of distal straight portions (150A, 150B) extending radially outward from opposite ends of the arcuate portion.

11. A method for manufacturing an annular vacuum seal (20; 120) for sealing first and second opposed flanges (100A, 100B) to maintain an internal pressure less than an external  
20 pressure, the seal having nested inner (22; 122) and outer (24; 124) members:

welding ends of a piece of a first metal together to form a first band;

die-forming the first band into a generally c-shaped, open radially outward,

cross-section so as to form the inner member (22; 122) having a wall thickness effective to resist compression of the seal between the first (100A) and second (100B) flanges so as to

25 maintain the outer member (24; 124) in sealed engagement with the first (100A) and second (100B) flanges to maintain said internal pressure;

inserting a second band of a second metal within the first band;

forming the second band into a c-shaped cross-section around the inner member (22; 122); and

30 roll-forming first and second opposed, longitudinally outward projecting, annular ridges in the second band to provide the outer member (24; 124).

12. The method of claim 11 wherein:



the inner member is plated prior to insertion of the second band; and  
the ridges are flat lapped.

13. An annular vacuum seal (20; 120) for sealing first and second opposed flanges  
5 (100A,100B) to maintain an internal pressure less than an external pressure, the seal (20)  
having nested inner (22; 122) and outer (24; 124) members and having a longitudinal radial  
section which is consists essentially of:
- the outer member (24; 124) being generally c-shaped and open radially outward;  
the inner member (22; 122) nested within the outer member (24) and being generally  
10 c-shaped and open radially outward and having a wall thickness effective to maintain the outer  
member in engagement with the first and second flanges; and  
optionally one or more coating or plating layers.

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## CLAIMS

1 A vacuum seal (20; 120) for sealing a pair of opposed metal flanges (110A, 100B), the seal (20; 120) comprising an outer metallic annular member (24; 124) having a generally c-shaped longitudinal radial cross-section and an inner metallic annular member (22; 122) having a generally c-shaped longitudinal radial cross-section, wherein the outer metallic  
5 annular member (24; 124) has a pair of oppositely-directed, longitudinally outward-projecting, ridges (40A, 40B) for deformably engaging the pair of opposed metal flanges (100A, 100B) and the inner metallic annular member has longitudinal strength and elasticity effective to maintain the ridges (40A, 40B) in engagement with the flanges.

10 2. The seal of claim 1 wherein the inner metallic annular member (22; 122) has a characteristic thickness of between about 2 and 4 times a characteristic thickness of the outer metallic annular member (24; 124).

15 3. The seal of any of claims 1 or 2 wherein the inner metallic annular member (22; 122) is formed of a nickel-based superalloy and the outer metallic annular member (24; 124) is formed of an aluminum-based material.

20 4. An annular vacuum seal (20; 120) for sealing first and second opposed flanges (100A, 100B) to maintain an internal pressure less than an external pressure, the seal (20) having nested inner (22; 122) and outer (24; 124) members and having a longitudinal radial section which is characterized by:

the outer member (24; 124) being generally c-shaped and open radially outward; and  
the inner member (22; 122) nested within the outer member (24) and being generally  
25 c-shaped and open radially outward and having a wall thickness effective to maintain the outer member in engagement with the first and second flanges in the absence of a coil spring nested within the inner member.

30 5. The seal of claim 4 wherein:  
the inner member (22; 122) has a full plating of a copper-base material.

6. The seal of claim 4 wherein:

the inner member (22; 122) is formed of a nickel-base superalloy; and  
the outer member (24; 124) is formed of an aluminum-base material.

7. The seal of any of claims 4-6 being effective to provide a leakage rate of no more than  
5 about  $4 \times 10^{-12}$  cm<sup>3</sup>/s-mm.

8. The seal of any of claims 1, 2, 4, 5 or 6 wherein the inner metallic annular member  
(122) longitudinal radial cross-section has a central arcuate portion and a pair of distal straight  
portions extending radially outward from opposite ends of the arcuate portion.

9. A method for manufacturing an annular vacuum seal (20; 120) for sealing first and  
second opposed flanges (100A, 100B) to maintain an internal pressure less than an external  
pressure, the seal having nested inner (22; 122) and outer (24; 124) members:

welding ends of a piece of a first metal together to form a first band;

15 die-forming the first band into a generally c-shaped, open radially outward,  
cross-section so as to form the inner member (22; 122) having a wall thickness effective to  
resist compression of the seal between the first (100A) and second (100B) flanges so as to  
maintain the outer member (24; 124) in sealed engagement with the first (100A) and second  
(100B) flanges to maintain said internal pressure;

20 inserting a second band of a second metal within the first band;

forming the second band into a c-shaped cross-section around the inner member (22;  
122); and

roll-forming first and second opposed, longitudinally outward projecting, annular ridges  
in the second band to provide the outer member (24; 124).

25 10. The method of claim 9 wherein:

the inner member is plated prior to insertion of the second band; and  
the ridges are flat lapped.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/07692

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :F16J 15/08  
US CL :277/606

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 277/606, 608, 612, 626, 627, 644, 647, 651, 652, 653

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 4,218,067 A (HALLING) 19 August 1980 (19/08/80), see entire document.	4-7 ----- 1-3 and 8-10
Y	US 4,561,662 A (DE VILLEPOIX ET AL) 31 December 1985 (31/12/85), see entire document.	1-3 and 8-10
Y	US 3,058,750 A (TAYLOR) 16 October 1962 (16/10/62), see figure 4 and the description thereof.	8
A	US 3,083,023 A (CREAVEY) 26 March 1963 (26/03/63), see figure 2 and the description thereof.	1, 2, 4 and 8
A	US 3,188,100 A (DELGADO) 08 June 1965 (08/06/65), see entire document.	1, 2, 4, 5, 9 and 10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*-&* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

12 JUNE 2000

Date of mailing of the international search report

28 JUL 2000

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**INTERNATIONAL SEARCH REPORT**International application No.  
PCT/US00/07692**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,261,584 A (BROWNE ET AL) 14 April 1981 (14/04/81), see entire document.	1, 2, 4 and 7
A	US 4,477,087 A (SUTTER, JR. ET AL) 16 October 1984 (16/10/84), see figures 5-7 and the description thereof.	1, 2, 4 and 5
A	US 4,915,397 A (NICHOLSON) 10 April 1990 (10/04/90), see figure 4 and the description thereof and column 3, lines 7-13.	1, 2, 4 and 5
A	US 5,022,663 A (FAGES ET AL) 11 June 1991 (11/06/91), see entire document.	1, 4, 9 and 10